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## EUROPEAN PATENT APPLICATION

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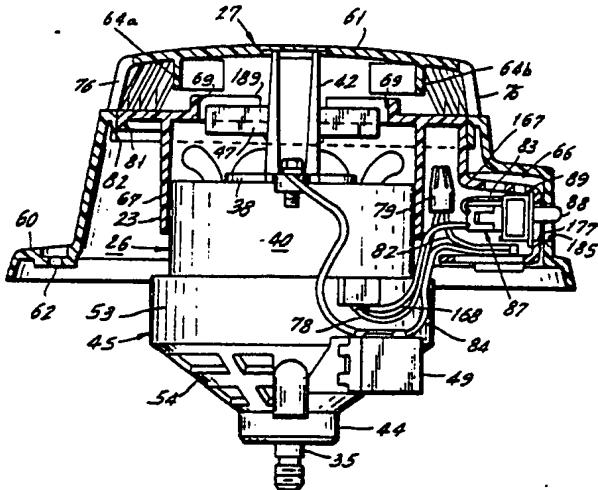
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### (54) Motor cap and housing for wet/dry vacuum.

(57) A wet/dry vacuum cleaner (20), including an accumulating tank (21) having a removable top (25) which mounts an electric motor (26) and suction producing fan (29) driven by the motor (26), is provided with a molded plastic cap (23) for the motor (26) and a separate molded plastic cover (27) fitted over the cap (23). An electric junction box (167) molded integrally with the cap (23) is provided with a snap-fitted removable perforated cover (170). The motor cover (23) is provided with inlet and exhaust apertures (76, 77) for motor cooling air, and cooperates with the cap (23) to direct the cooling air from the inlet (76), through the motor (26) and out the exhaust (77) while some of the cooling air also passes through the junction box (167). To facilitate inspection and servicing, the motor cover (27) and cap (23) are removable without disturbing mechanical mounting of other components and without opening the junction box (167).



-FIG. 3-

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## **MOTOR CAP AND HOUSING FOR WET/DRY VACUUM**

## BACKGROUND OF THE INVENTION

This invention relates to so-called bypass type electric motor operated vacuum cleaners, and more particularly relates to a construction that is an improvement of that disclosed in U.S. Patent No. 4,538,971 issued September 3, 1985 to J. Miller et al. and entitled "Assembly of Tank Lid and Fan Means for a Wet/Dry Vacuum."

Many so-called bypass type vacuum cleaners include a tank having a lid forming a removable closure for the top opening of the tank wherein sweepings are collected. This lid also mounts a housing for a fan impeller, an electric motor for rotating the impeller and a molded insulating housing for the motor. As described in U.S. Patent No. 4,330,899 issued May 25, 1982, to J Miller et al. for "Noise Reducing Blower Motor Housing Means For Vacuum Cleaner, Or The Like", the motor housing is also provided with internal partitions that separate motor cooling air generated by an auxiliary fan from the working air generated by the vacuum producing main fan. In addition, housing partitions are provided to define plenums wherein the velocity of working airflow is reduced before the working air is discharged from the motor housing.

Typically, in prior art constructions of this type assembly of the lid with elements mounted thereto is a tedious job which requires subassemblies to be repositioned many times before the assembly is completed. The construction according to the teachings of the aforesaid U.S. Patent No. 4,538,971 is such that after two elements are secured to one another, they need not be repositioned in order to attach another element thereto. This is accomplished by providing a construction in which the main elements to be assembled consist of an electric motor having a lower insulating housing, a cover for the upper end of the motor, a blower housing including vanes for regulating flow of main blower air, a fan having a pancake type impeller, a fan cover and a tank lid having an integrally formed float cage.

While this last construction achieves substantial economies insofar as assembly operations are concerned, similar economies were not achieved when servicing becomes necessary, probably because disassembly requires adherence to a strict sequence. For example, in order to service the ON-OFF control switch it was necessary to disassemble virtually all major components from each other.

### **BRIEF DESCRIPTION OF THE INVENTION**

The instant invention overcomes the aforesaid problem by providing a construction in which the motor cover of the aforesaid U.S. Patent No. 4,538,971 is replaced by a motor cover having a separate motor cap disposed therein and molded of flame retardant electrical insulating material. The motor cap is snap fitted to the upper end of the motor field stack and the motor cover is placed over the motor cap and secured to the blower housing by screws that are accessible from outside the motor cover. This enables the motor cover and motor cap to be removed without disturbing motor mounting or other elements that are connected to the motor.

20 A junction box for mounting an ON-OFF control switch and enclosing electrical connections is molded integrally with the motor cap and is provided with a snap fitted removable perforated cover and a perforated horizontal wall opposite the cover. The cover of the junction box will not open accidentally and will not open merely because the motor cover and/or cap are dismounted.

25 Partitions in the motor cover and motor cap  
cooperate to direct motor cooling air, from inlet  
openings in the motor cap, downward through the  
inside of the field stack, upward along the outside  
of the field stack and out through exhaust openings  
in the motor cover. Some of the air moving upward  
toward the exhaust openings passes through the  
junction box to cool the elements therein.  
30

Accordingly, the primary object of the instant invention is to provide a novel construction for a bypass type vacuum cleaner.

Another object is to provide a novel vacuum cleaner of this type constructed to facilitate servicing and improve safety during servicing.

Still another object is to provide a novel vacuum cleaner of this type constructed to facilitate assembly.

45 A further object is to provide a novel vacuum cleaner of this type in which the motor cover encloses a motor cap that is molded of flame retardant material and has a junction box formed integrally therewith.

A still further object is to provide a novel vacuum cleaner of this type in which the junction box formed integrally with the motor cap is provided with a snap fitted cap that will not open incidental to performance of another disassembly procedure.

These objects as well as other objects of this invention shall become readily apparent after reading the following description of the accompanying drawings in which:

### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a vertical cross-section of a bypass type vacuum cleaner constructed in accordance with teachings of the instant invention.

Figure 2 is a side elevation showing major elements of Figure 1 separated from one another

Figure 3 is a vertical cross-section of the motor housing and motor cap with the electric motor assembled thereto.

Figure 4 is a bottom view of the motor cover.

Figure 5 is a cross-section taken through line 5-5 of Figure 4 looking in the direction of arrows 5-5.

Figure 6 is an exploded side elevation of the motor cover, motor cap and junction box cover.

Figure 7 is a side elevation, partially sectioned, of the junction box.

Figure 8 is a cross-section taken through line 8-8 of Figure 7 looking in the direction of arrows 8-8.

Figure 9 is a top plan view of the motor cap.

Figure 10 is a cross-section taken through line 10-10 of Figure 9 looking in the direction of arrows 10-10.

Figure 11 is a bottom view of the motor cap looking in the direction of arrows 11-11 of Figure 10.

Figure 12 is a side elevation looking in the direction of arrows 12-12 of Figure 11.

Figure 13 is an exploded perspective of the motor housing, motor cap and junction box cover with these elements inverted.

### DETAILED DESCRIPTION OF THE DRAWINGS

Now referring to the drawings in which Fig. 1 illustrates the upper portion of so-called bypass type vacuum cleaner 20 including vertically upright tank 21, circular in horizontal cross-section, having lid assembly 25 removably secured to its upper end by a plurality of pivoted latches 24. Inlet fitting 22 for the attachment of a vacuum hose is secured to tank 21 at a side opening near the top thereof.

The main elements of assembly 25 are electric motor 26, inverted cup-like motor cover 27, cap 23, blower housing 28, pancake type fan impeller 29, fan cover 31 and tank lid 32 having float cage 33 depending therefrom and formed integrally therewith. The upper end of motor 26 is disposed within cap 23 and the lower end of motor 26 is disposed within depression 34 in the upper surface of blower housing 28. Impeller 29 is secured to the lower end of motor shaft 35 and is disposed within chamber 36 formed between formations of housing 28 and cover 31. In a conventional manner, ball type float 37 is disposed within cage 33 and positioned below

cover 31.

As seen best in Fig. 3, in addition to vertically positioned shaft 35, motor 26 includes wound rotor 38 mounted to shaft 35 and disposed within the central passage through laminated pole piece means 40. An upper bearing (not shown) for shaft 35 is secured to the web portion of inverted U-shaped metal bracket 42 and a lower bearing 43 (Fig. 2) for shaft 35 is disposed within annular extension 44 at the lower end of molded insulated lower housing 45. Screws (not shown) extend through outwardly turned feet of bracket 42 and through clearance apertures in pole piece 40, and are threadably received in apertures of lower housing 45 to sandwich pole means or field stack 40 in operative position between bracket 42 and lower housing 45. Cooling fan blade 47 is mounted to the upper end of motor shaft 35 and rotates between the spaced arms of bracket 42. Rotor 38 is electrically energized through a pair of carbon brushes 48 disposed within radially extending housings 49 formed integrally with housing 45. A coiled compression spring (not shown) disposed within brush housing 49 biases the radially inner end of each brush 48 against the commutator 51 mounted on shaft 35. The upper portion 53 of housing 45 is generally cylindrical and is connected to annular extension 44 by perforated conical section 54. Lower housing 45 is also provided with apertures that threadably receive screws 55 (Fig. 1) which secure lower housing 28 directly to motor 26. The upper end of field piece 40 extends into cap 23 which is disposed within cover 27. For a reason to be seen hereinafter, cap 23 is molded of plastic flame retardant material.

As seen in Figs. 4-6 and 13, motor cover 27 is an inverted cup-shaped member including sloping annular side wall 59 that extends downward from slightly convex horizontal top wall 61. Extending outwardly from the bottom of wall 59 is annular shoulder 60 having three clearance apertures 62 which receive individual screws 63 (Fig. 1) that secure motor housing 27 directly to lower housing 28. The slightly inwardly stepped upper portion of sidewall 59 is provided with diametrically opposed sets of motor cooling air inlet apertures 76, and the lower portion of sidewall 59 is provided with diametrically opposed sets of cooling air exhaust apertures 77. The sets of intake apertures 76 are offset from exhaust apertures 77 by approximately 90°. Aligned with and inboard of intake apertures 76 are the two sections 64a, 64b of an interrupted arcuate partition that extends downward from upper wall 61. Portion 65 of sidewall 59 bulges outwardly to define internal pocket 66 that receives junction box 67 formed integrally with motor cap 23.

As seen best in Figs. 9 through 13, motor cap 23 includes generally annular skirt 67 that extends

downward from flat horizontal top wall 68 having short generally annular interrupted partition 69 extending upward therefrom. Skirt 67 and partition 69 are essentially coaxial. The periphery of top wall 68 is provided with downwardly extending lip 81 which, when cap 23 and cover 27 are assembled (Fig. 3), lies adjacent to the inner surface of annular lip 82 in the interior of motor cover 27. Diametrically opposite portions of wall 67 are flattened to conform with the sidewall of field stack 40, the upper portion of which extends into the area surrounded by wall 67.

Lip 69 that extends upwardly from topwall 68 of cap 23 borders large circular aperture 189 (Fig. 13) in wall 68. At diametrically opposed breaks in lip 69, wall 68 is provided with C-shaped notches 195 which provide clearances for the rib portions 196 along arms of bracket 42.

Notch 67a extending upwardly from the bottom of wall 67 provides clearance for horizontally projecting grounding terminal 83 of motor bracket 42. Diametrically opposed to notch 67a is rectangular aperture 67b which receives a slight projection (not shown) that extends horizontally outward from the side of bracket 42 opposite terminal 83, there being a snap fit between this projection and aperture 67 so that there will not be accidental disengagement of motor cap 23 from motor 26.

Junction box 167 formed integrally with motor cap 23, projects outwardly from sidewall 67 thereof. Box 167 is generally rectangular, having perforated top wall 168 and an open bottom that is normally closed by perforated cover 170 having elongated slots 171 at opposite ends thereof. Slots 171 receive retainer projections 172 that extend downward from opposite endwalls of junction box 167. The free end portions of projections 172 are provided with short clips 199 that project outwardly so as to be in blocking relationship with cover 170 when the latter is mounted to box 167. There is sufficient resiliency in projections 172 to permit inward deflection thereof for dismounting cover 170 from box 167.

Exterior sidewall 174 of box 167 is provided with notch 176 that is partially closed by cover 170 to define rectangular aperture 177 through which horizontally slidable manual operating handle 88 of ON-OFF control switch 87 extends. Opposite edges of mounting plate 89 for switch 87 are captured within interior slots 181 (Fig. 13) of box 167. Strain relief 136 surrounding three conductor line cord 79 is received by formation 137 in shoulder 60 of motor housing 27. Grounding lead 84 of line cord 75 is connected directly to bracket terminal 83, line cord conductor 82 and motor lead 78 are connected to one another by wire nut 79, disposed within box 167, the other motor lead 168 is connected to one terminal of switch 87, and conductor

83 of line cord 75 is connected to the other terminal of switch 87. Motor conductors 78 and 168 extend into box 167 through clearance 183 (Fig. 8) which also provides a space for the entry of line cord conductor 83. Rectangular aperture 185 in motor cover 27 is in alignment with junction box aperture 177 so that ON-OFF control 88 is accessible from outside of cover 27.

With motor 26, cap 23 and cover 27 assembled (Fig. 3), junction box 167 is disposed within cover recess 66 and internal lip 82 of cover 27 surrounds cap lip 81 in snug engagement therewith. With motor 26 energized, motor cooling fan 47 rotates and draws air into housing 27 through inlet slots 76. This air moves along the upper surface of wall 68 and downward through aperture 189, then downward through motor 26 to cool the elements thereof. After performing its cooling function the air moved by rotation of fan 47 flows upward along the outside of field stack 40 and cap sidewall 67, leaving housing 27 through exhaust slots 77. A portion of this upwardly moving cooling air circulates through junction box 167 by means of the apertures in its top wall and bottom cover 170.

As illustrated and explained in detail in the aforesaid U.S. Patent No. 4,538,971, blower housing 28 is a member molded of plastic material and includes two clearance apertures for screws 55 that mechanically secure housing 28 directly to lower motor cover 45. In addition, housing 28 is provided with depressed portion 131 having centrally located short upwardly extending sleeve 92 that is closely fitted around the outside of downward extension 44 of lower motor cover 45 to form a water-tight seal. Inclined upper edge surfaces of webs 93 engage the conical exterior surface 54 of blower motor housing 45 to fix the position of motor 26 at its lower end.

Housing 28 is provided with exhaust port 94 which is laterally offset from depressed portion 131 and communicates with an expansion plenum that receives the main stream of air produced by rotation of impeller 29 after such air passes through vanes 96, formed integrally with blower housing 28 at the bottom thereof, and along the outer side surface of depressed portion 131. Vanes 96 are disposed in a circular array above and slightly outboard of the periphery of impeller 29.

Fan cover 31 is in the form of a shallow dish 99 that provides chamber 36 wherein impeller 29 is disposed. Outwardly extending lip 101 at the upper end of dish 99 is provided with three clearance apertures 102 through which screws 103 (Fig. 1) extend to mechanically secure fan cover 31 directly to the bottom of blower housing 28. Air intake aperture 106 disposed at the center of dish 99 is covered by grillwork 107. Surrounding intake aperture 106 and extending downward from dish 99 is

annular flange 108 which is of the diameter and length that will permit ball 37 to be floated into sealing engagement therewith. Ribs 109 extend radially outward from flange 108 to rigidify cover 31.

Annular flange 133 extending upward from lid 32 closely surrounds lip 101 of fan cover 31 while downwardly extending annular flange 138 of lid 32 lies adjacent the inner side surface of tank 21. Seven screws 112 extend upward through clearance apertures in lid 32 and are threadably received in bores 114 of blower housing 28 to mechanically secure the latter to lid 32. Lip 101 is also sandwiched between lid 32 and portions of blower housing 28 so that cover 31 cannot be removed while lid 32 is secured to housing 28.

Should it become necessary to check the electrical connections, access thereto is obtained by merely removing three screws 63 that are accessible from outside of motor housing 27 and, if necessary, snapping motor cap 23 away from motor 26 and removing cover 170 from junction box 167. All this is accomplished without in any way interfering with the mounting of motor 26.

It should now be apparent to those skilled in the art that a strap (not shown) may be used to loosely hold cover 170 to box 167 so that the former will not be misplaced when box 167 is open. This strap may be formed as a separate element or may be molded integrally with one or both of the components 167, 170.

Junction box cover 170 is also molded of plastic material that is fire resistant so that if the remaining portions of vacuum 20 are destroyed by fire, the electrical connections within junction box 167 will not be exposed.

Although the present invention has been described in connection with a plurality of preferred embodiments thereof, many other variations and modifications will now become apparent to those skilled in the art. It is preferred, therefore, that the present invention be limited not by the specific disclosure herein, but only by the appended claims.

## Claims

1. A removable lid assembly for a bypass type vacuum cleaner; said assembly including a concave motor cover, a cap within said cover and separable therefrom, an electric motor disposed with its upper portion within said cap and having a vertical output shaft, housing means having the lower portion of said motor disposed therein and secured thereto, a suction producing fan impeller secured to said lower portion of said shaft, said housing means defining a chamber in which said

impeller rotates, said impeller when rotating drawing suction producing air upward through an opening in said housing means and directing said air radially outward past flow regulating vanes into an expansion chamber partially defined by said housing means and a removable tank lid which supports the motor cover, the cap, the motor and the housing means; said housing means being secured to said tank lid by first fastening means; said motor cover being secured to said housing means by second fastening means inserted at the top side of said motor cover to permit dismounting of said motor cover and said cap from said motor while the latter remains secured to said housing means and said impeller.

2. An assembly as in claim 1 also including a junction box wherein electrical connections to said motor are disposed; a switch disposed within said box and having an operating handle that projects through aligned apertures in said junction box and said motor cover to be accessible for operation from outside of said motor cover; an openable box cover mounted to said box and normally closing a bottom opening thereof; said box being formed integrally with said cap.

3. An assembly as in claim 2 in which said box cover and an upper wall of said box opposite said box cover are provided with perforations to permit air to be drawn through said box and cool elements therein.

4. An assembly as in claim 1 in which the cap is snap fitted to the motor.

5. An assembly as in claim 1 in which the motor cover is provided with interior formations that position said cap and cooperate therewith to separate motor cooling air being drawn into said motor cover through upper entrance openings thereof from motor cooling air being driven from said motor cover through side exhaust openings thereof.

6. An assembly as in claim 5 in which said interior formations include a short vertical annular wall and said cap includes an arcuate lip adjacent to said annular wall and disposed interiorly thereof to seat thereagainst and cooperate therewith in establishing relative horizontal positions between said motor cover and said cap.

7. An assembly as in claim 2 in which the motor cover is provided with interior formations that position said cap and cooperate therewith to separate motor cooling air being drawn into said motor cover through upper entrance openings thereof from motor cooling air being driven from said motor cover through side exhaust openings thereof.

8. An assembly as in claim 7 in which said box cover and an upper wall of said box opposite said box cover are provided with perforations to permit air to be drawn through said box and cool elements therein.

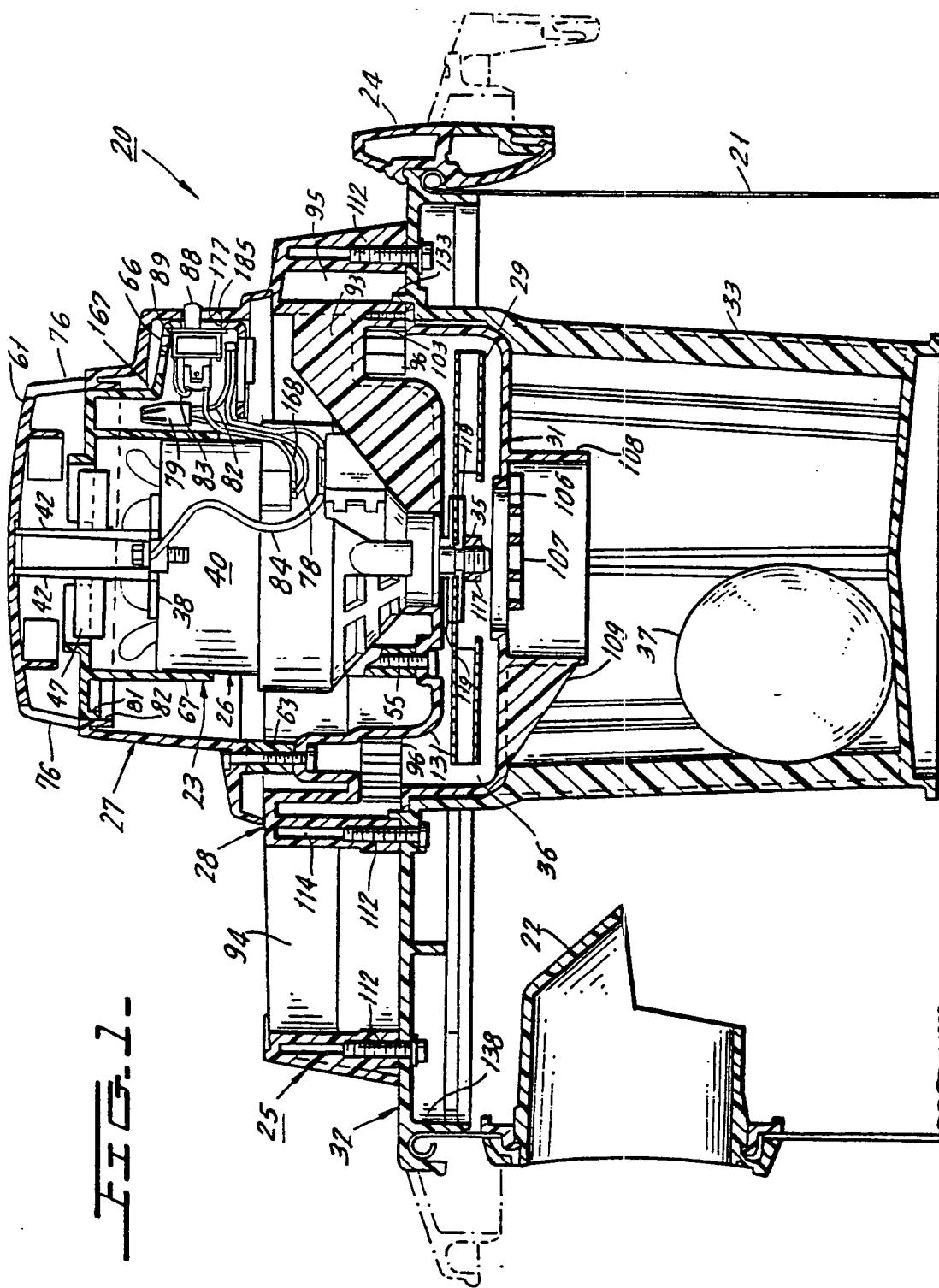
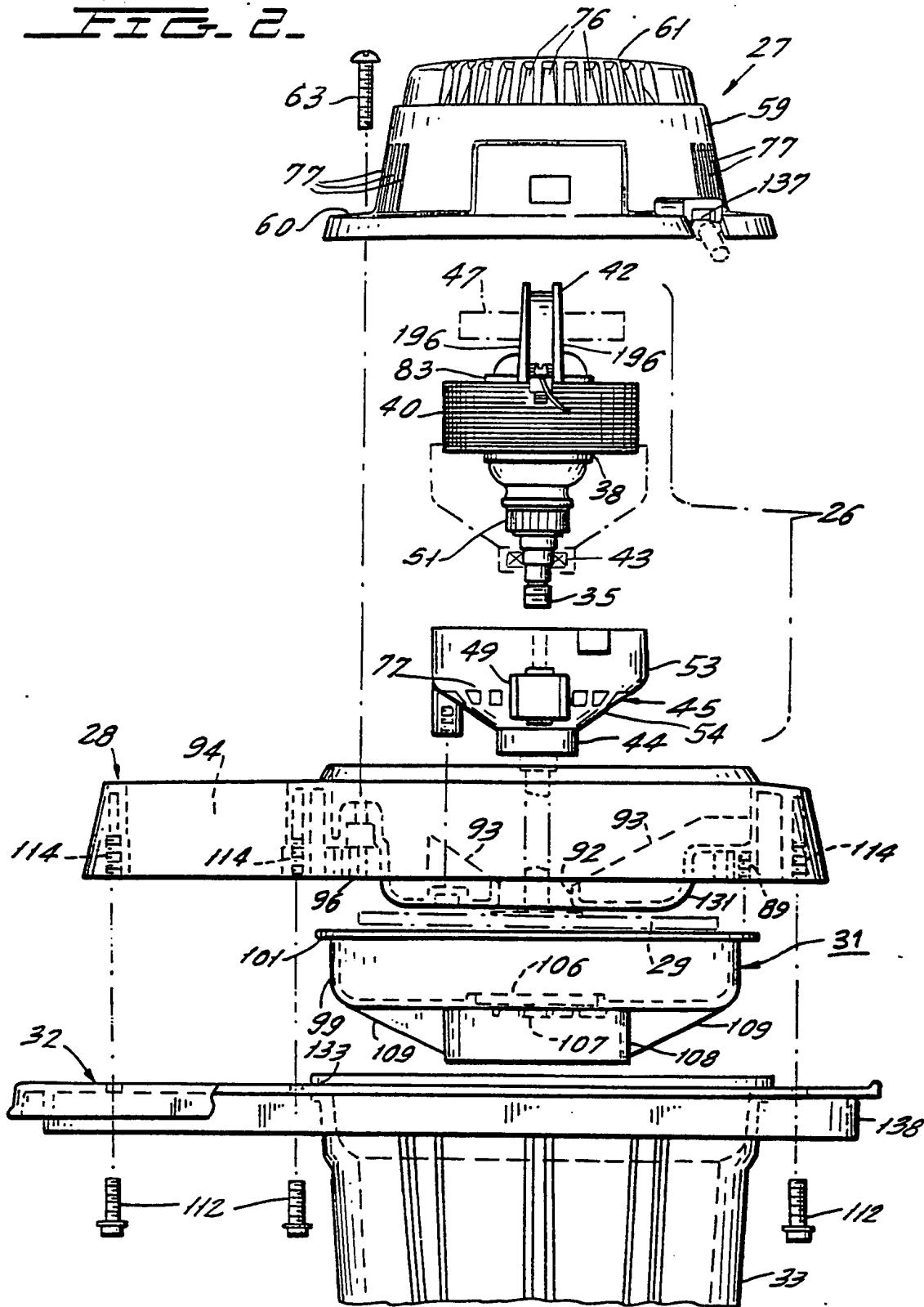


FIG. 2.



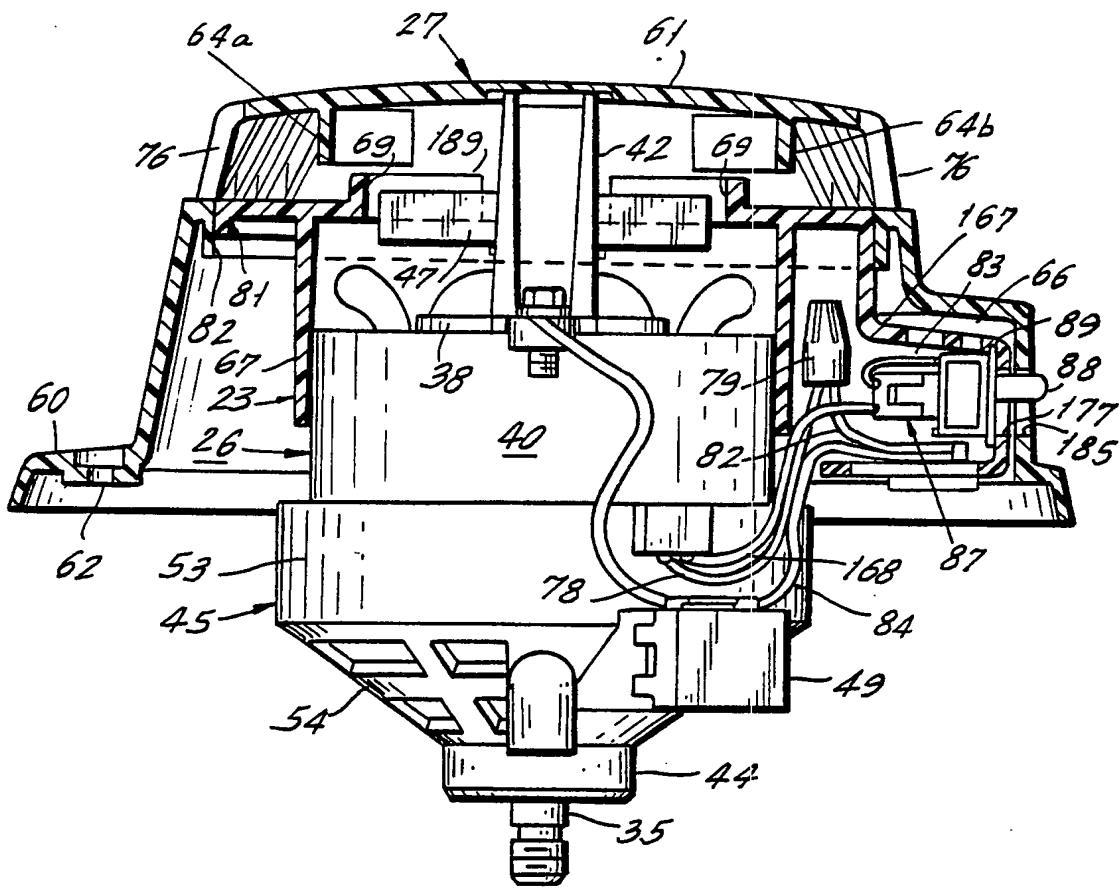


FIG. 3.

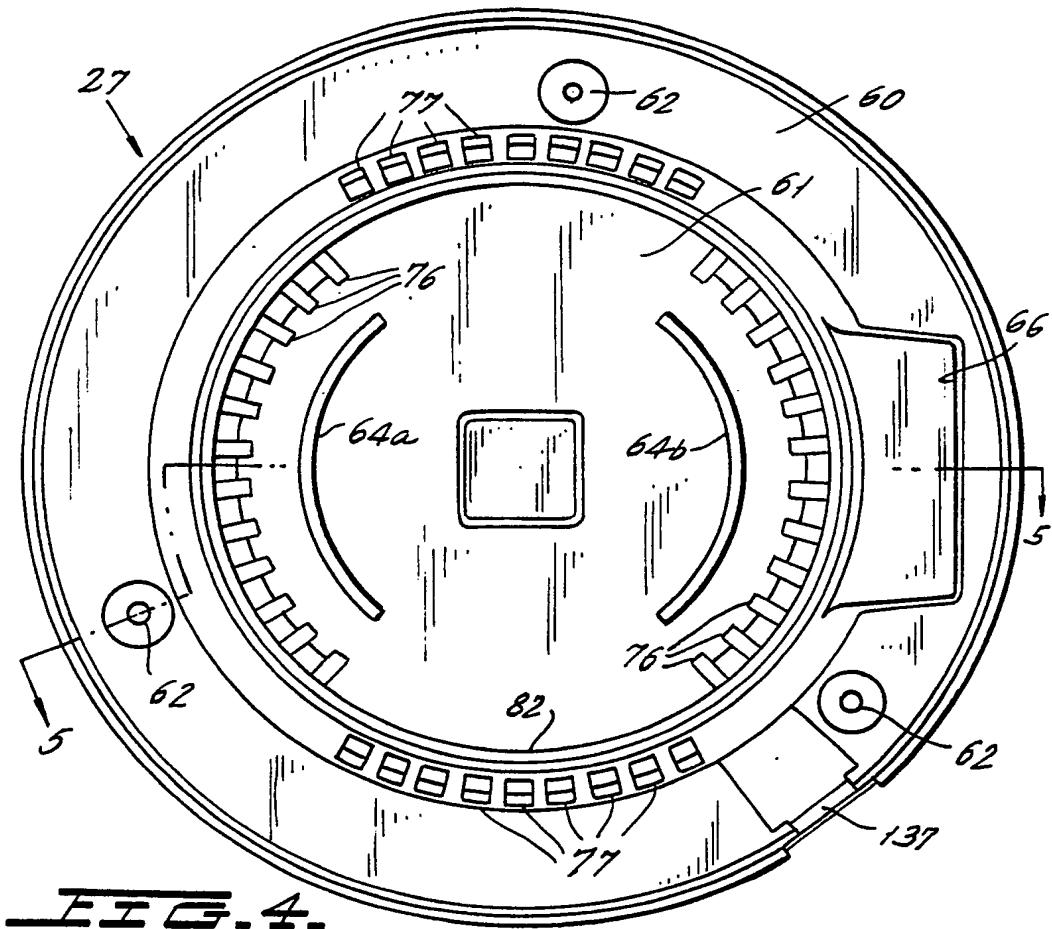
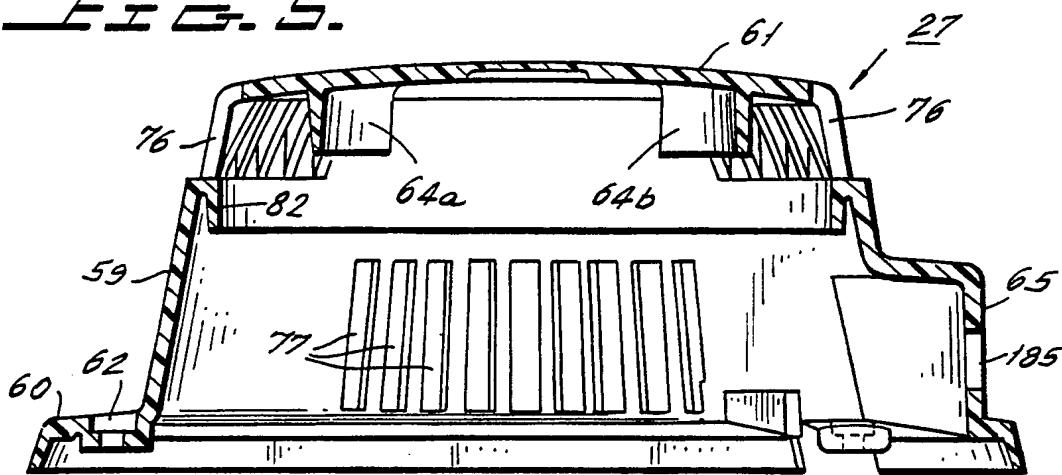
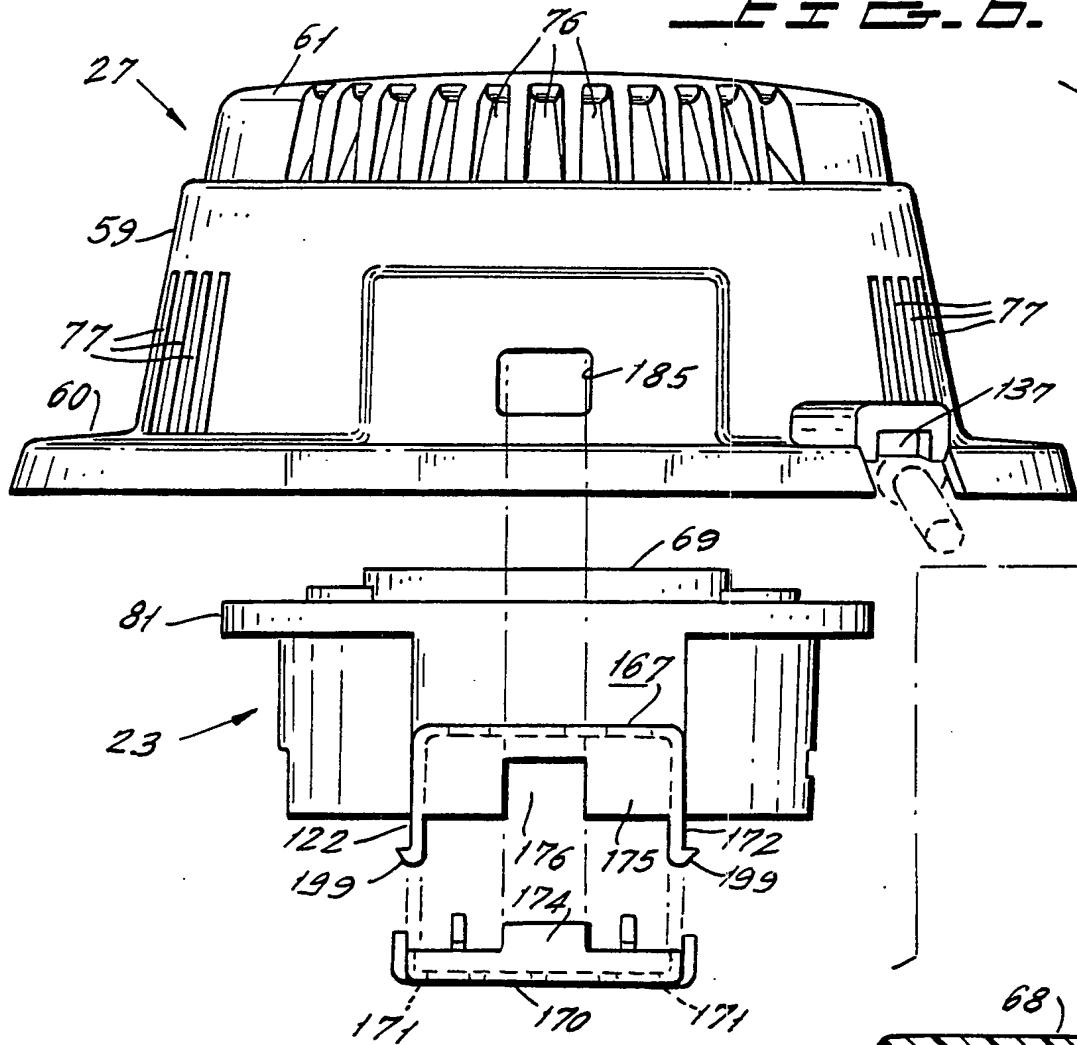
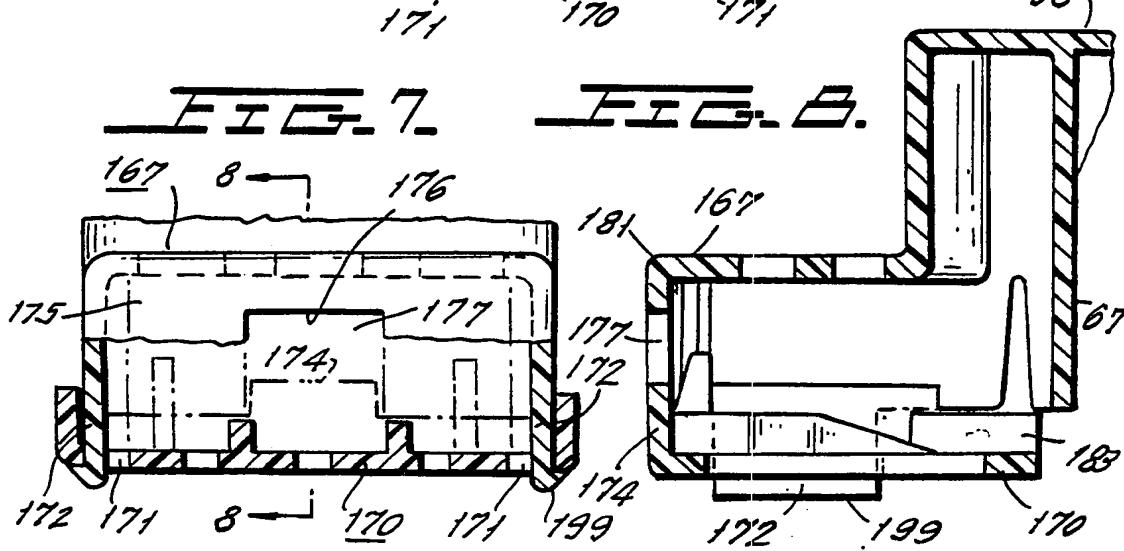
FIG. 5.FIG. 4.

FIG. 6.FIG. 7.FIG. 8.

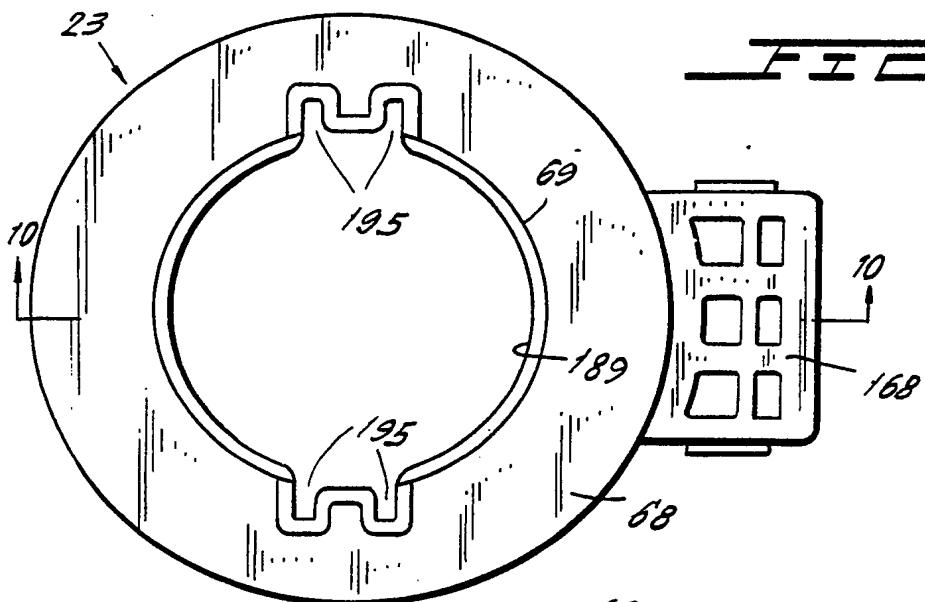


FIG. 9

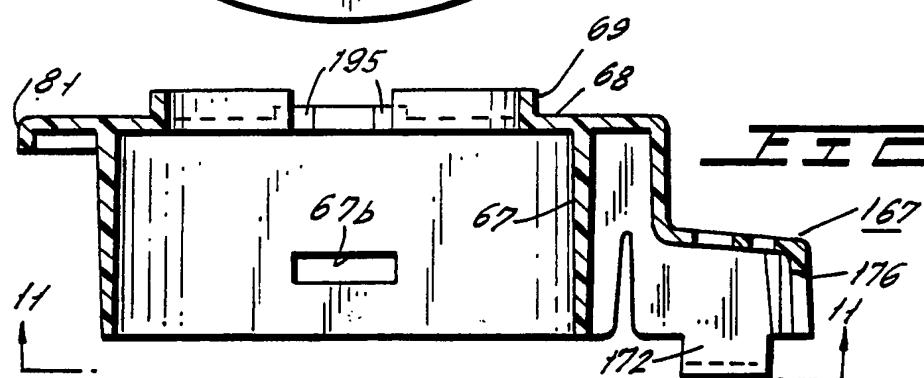


FIG. 10

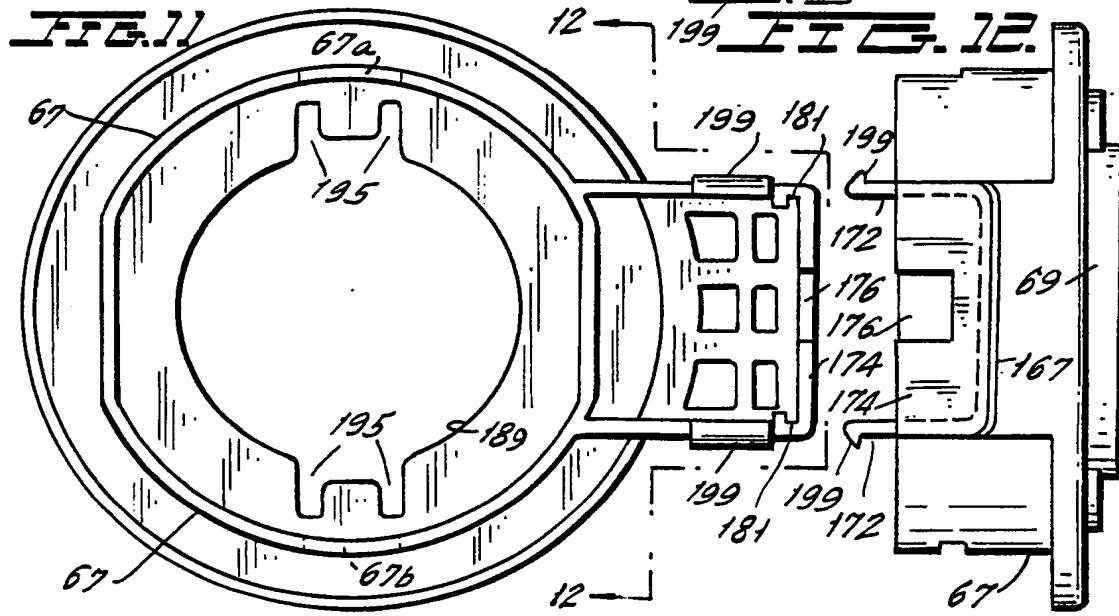
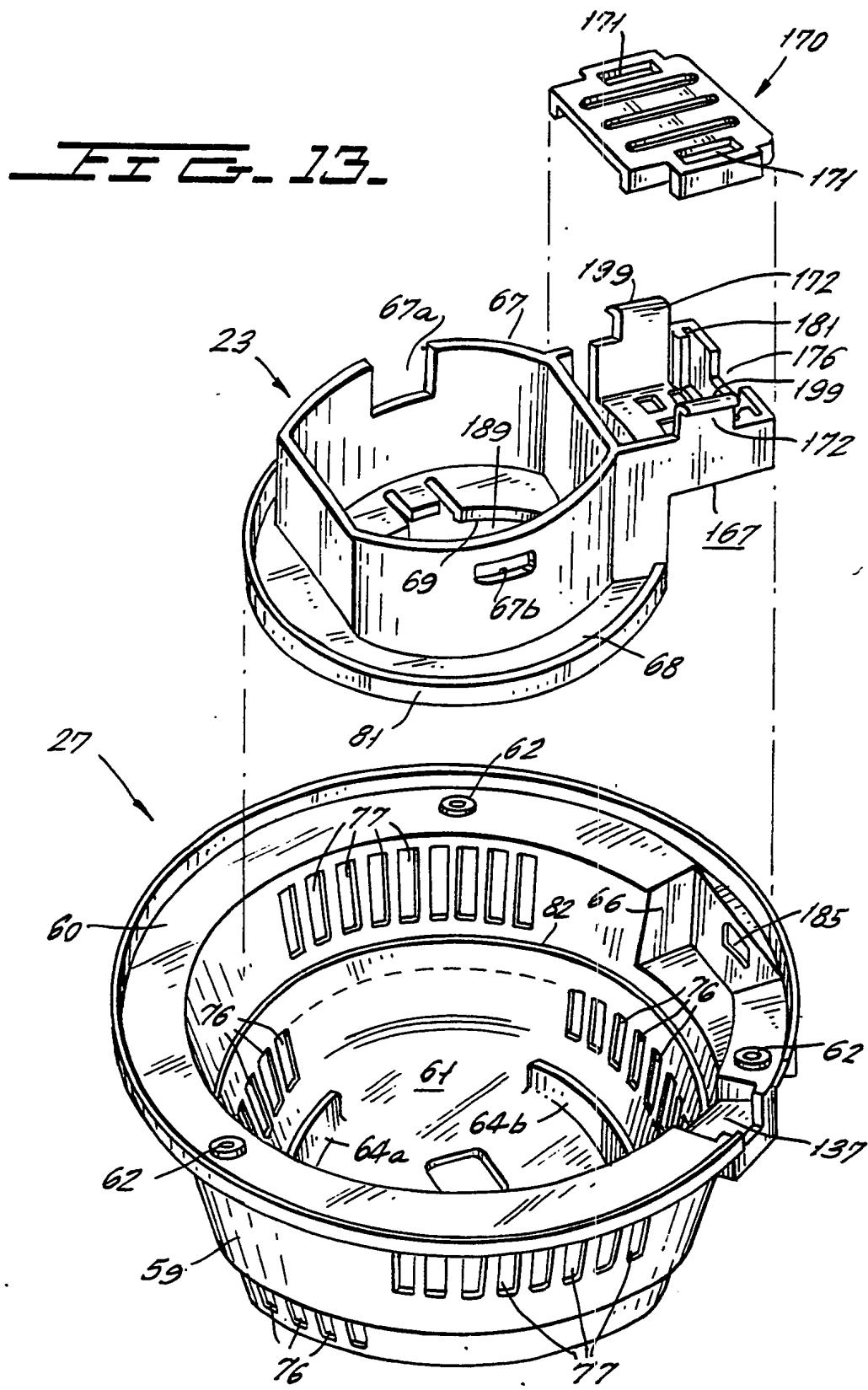


FIG. 11

FIG. 12





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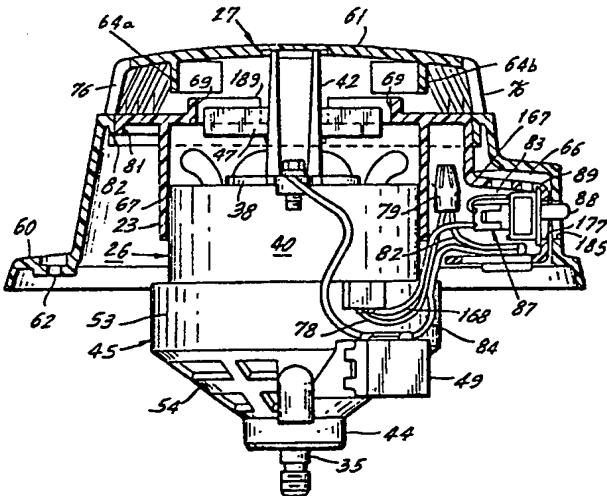
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- FIG. 3 -

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EP 87 11 7458

**DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
D, X	US-A-4 538 971 (MILLER) * claim 1; figure 1, positions 27,28 * ---	1,2	A 47 L 7/00 A 47 L 9/22
D, A	US-A-4 330 899 (MILLER) * figure 2; claim 1 * ---	1	
X	US-A-3 780 397 (HARBECK) * claim 1; figure 2 * ---	1,5-7	
X	US-A-3 815 172 (FROMKNECT) * claims 1,2,7; figure 2 * ---	1,5,6	
A	US-A-4 138 761 (NAUTA) * claim 1; figure 4 * -----	1	
TECHNICAL FIELDS SEARCHED (Int. Cl.4)			
A 47 L 7/00 A 47 L 9/00			

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	07-07-1988	SCHLAITZ J
<b>CATEGORY OF CITED DOCUMENTS</b>		
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document		